National Aeronautics and
Space Administration

Space Launch System
Highlights

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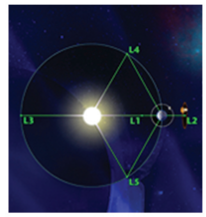


NASA's Most Powerful Engine Blazes Path for Space Launch System Advanced Propulsion

To help develop the nation's future heavy-lift rocket, NASA resurrected the world's most powerful rocket engine ever flown—the mighty F-1 that powered the Saturn V rocket—and conducted a series of test firings in January of its gas generator at NASA's Marshall Space Flight Center in Huntsville, Ala.

The gas generator from an F-1 engine is test-fired at the Marshall Space Flight Center on Jan. 24. Data from the 30-second test will be used in the development of advanced boosters for NASA's Space Launch System, which is managed at Marshall. *(Image: NASA/MSFC)*

NASA engineers ran the gas generator at Marshall's Test Stand 116. The test is part of a series that will push the gas generator to limits beyond Apollo-era tests. Modern instruments on the test stand measured performance and combustion properties to allow engineers a starting point for creating a new, more affordable, advanced propulsion system for the 143-ton (130-metric-ton) version of the Space Launch System.

The gas generator tested at Marshall is a key F-1 rocket component that burns liquid oxygen and kerosene and is the part of the engine responsible for supplying power to drive the giant turbopump. The gas generator is often one of the first pieces designed on a new engine because it is a key part for determining the engine's size, which is a factor in the engine's power and ability to lift heavy payloads and send them to space.

Orion and the Space Launch System Go International

As part of a new agreement between the two space agencies, the European Space Agency will provide the service module for NASA's Orion spacecraft for Exploration Mission-1. *(Image credit: NASA)*

When NASA's Orion spacecraft launches atop the Space Launch System (SLS) rocket on Exploration Mission-1 in 2017, a new service module designed and built by the European Space Agency (ESA) will be attached. The SLS Spacecraft & Payload Integration Office at NASA's Marshall Space Flight Center in Huntsville, Ala., will be working closely with European counterparts to ensure a safe and secure connection between the service module and the propulsion system.

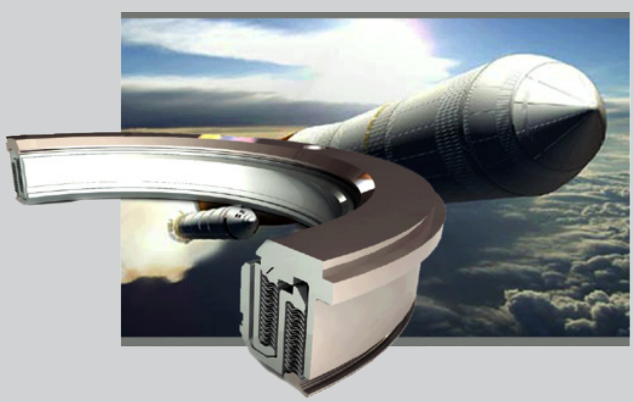
The ESA-provided service module will be located directly below the crew capsule and will contain the in-space propulsion capability for orbital transfer, attitude control, and high-altitude ascent aborts. It also will generate and store power and provide thermal control, water, and air for the astronauts. It will remain connected to the crew module until just before the capsule returns to Earth.

In 2014, Exploration Flight Test-1 will launch an uncrewed Orion capsule on top of a Delta IV rocket and fly to an altitude of 3,600 miles above Earth's surface, farther than a human-rated spacecraft has gone in 40 years. Exploration Mission-1 in 2017, which will include the ESA-built service module, will be the first flight test with both the Orion and fully integrated SLS rocket.

Spaceflight Partners: Flexial Corporation

EDITOR'S NOTE: Every month, SLS Highlights turns the spotlight on one of the industry partners helping to create the largest rocket ever built for human space exploration. In this issue, we profile Flexial Corp., in Cookeville, Tenn., approximately 60 miles east of Nashville.

Founded in 1994, Flexial Corp. has worked with NASA since 1999, when it designed and delivered accumulators to Goddard Space Flight Center in Greenbelt, Md. Employing nearly 100 people, the company designed and delivered multiple fluid and air management accumulators, seals, sensors and actuators that provide drinking water and manage wastewater for the environmental life support systems on the International Space Station. Accumulators and actuators built by Flexial also manage the cooling loop on the plutonium reactor for NASA's Mars Rover "Curiosity."



A cut-away view of the J-2X turbopump lift-off seal. *(Image: Flexial Corp.)*

For NASA's Space Launch System, Flexial designs and builds the J-2X turbopump lift-off seal. This is a high-performance sealing technology to prevent leakage of hydrogen while the engine turbopump spins at up to 30,000 revolutions per minute. The J-2X engine, built by Pratt & Whitney Rocketdyne of Canoga Park, Calif., will power the upper stage of the evolved version of SLS that will have a 143-ton (130-metric-ton) lift capacity.

NASA Awards Space Launch System Advanced Development Grants

NASA has awarded grants to nine universities for advanced development activities for the Space Launch System—the nation's next heavy-lift rocket that is managed at NASA's Marshall Space Flight Center in Huntsville, Ala.

The agency is providing approximately $2.25 million that will be shared by all the proposals under this NASA Research Announcement to seek innovative and affordable solutions to evolve the launch vehicle from its initial lift capability to a larger, future version of the rocket, which will carry humans farther into deep space than ever before. NASA sought proposals in a variety of areas, including concept development, trades and analyses, propulsion, structures, materials, manufacturing, avionics, and software.

"Partnering with academia on SLS advanced concepts brings new ideas and vitality to NASA and expands the SLS team of rocket scientists beyond just the agency," said William Gerstenmaier, associate administrator for Human Exploration and Operations at NASA Headquarters.

Selected Proposals:

— "High Electric Density Device for Aerospace Applications," Auburn University in Auburn, Ala.

— "Challenges Towards Improved Friction Stir Welds Using On-line Sensing of Weld Quality," Louisiana State University in Baton Rouge

— "A New Modeling Approach for Rotating Cavitation Instabilities in Rocket Engine Turbopumps," Massachusetts Institute of Technology in Cambridge

— "Algorithmic Enhancements for High-Resolution Hybrid RANS-LES Using Loci-CHEM," Mississippi State University in Starkville

— "Characterization of Aluminum/Alumina/Carbon Interactions under Simulated Rocket Motor Conditions," Pennsylvania State University in College Park

— "Development of Subcritical Atomization Models in the Loci Framework for Liquid Rocket Injectors," University of Florida in Gainesville

— "Validation of Supersonic Film Cooling Numerical Simulations Using Detailed Measurements and Novel Diagnostics," University of Maryland in College Park

— "Advanced LES and Laser Diagnostics to Model Transient Combustion-Dynamical Processes in Rocket Engines: Prediction of Flame Stabilization and Combustion-Instabilities," University of Michigan in Ann Arbor

— "Acoustic Emission-Based Health Monitoring of Space Launch System vStructures," University of Utah in Salt Lake City

Artist's concept drawing of an evolved SLS rocket on the launch stand. *(Image: NASA/MSFC)*

SLS On the Road…

Steve Creech, manager of the Strategic Development Office for NASA's Space Launch System, takes questions from students at Blossomwood Elementary School in Huntsville, Ala., as part of an ongoing outreach effort with local schools. *(Image: NASA/MSFC)*

From left, NASA astronauts Serena Aunon and Kjell Lindgren sign autographs in front of a model of the Space Launch System, and chat with the public attending the presidential inauguration in Washington on Jan. 21. *(Image: NASA/MSFC)*

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